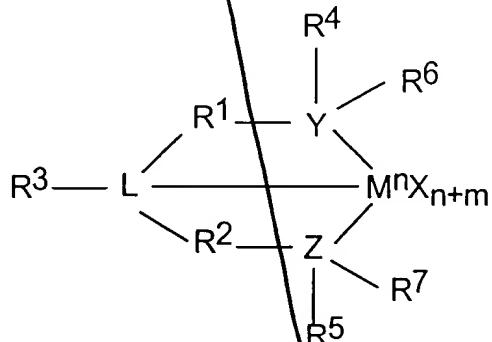


Claims:

1. A polymerization process comprising combining in the gas or slurry phase an olefin with an activator, a support and a compound represented by the following formula:

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wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

15 R<sup>1</sup> and R<sup>2</sup> are independently a C<sub>1</sub> to C<sub>20</sub> hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R<sup>1</sup> and R<sup>2</sup> may also be interconnected to each other,

R<sup>3</sup> is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

20 R<sup>4</sup> and R<sup>5</sup> are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

R<sup>6</sup> and R<sup>7</sup> are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.

2. The process of claim 1 wherein M is a group 4, 5 or 6 transition metal.

3. The process of claim 1 wherein M is zirconium or hafnium.

5 4. The process of claim 1 wherein each X is independently hydrogen, halogen or a hydrocarbyl group

5 5. The process of claim 1 wherein R<sup>1</sup> and R<sup>2</sup> are independently a C<sub>1</sub> to C<sub>6</sub> hydrocarbon group.

10 6. The process of claim 1 wherein R<sup>1</sup> and R<sup>2</sup> are a C<sub>1</sub> to C<sub>20</sub> alkyl, aryl or aralkyl group.

7. The process of claim 1 wherein m is 0, -1, -2, or -3 and n is +3, +4 or +5.

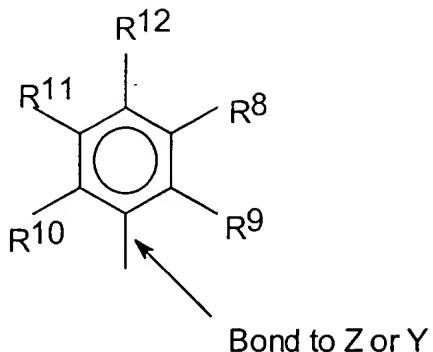
8. The process of claim 1 wherein R<sup>3</sup> is absent or hydrogen or methyl.

9. The process of claim 1 wherein R<sup>4</sup> and R<sup>5</sup> are independently a C<sub>1</sub> to C<sub>20</sub> hydrocarbon group.

20 10. The process of claim 1 wherein R<sup>4</sup> and R<sup>5</sup> are independently a C<sub>1</sub> to C<sub>20</sub> aryl group or a C<sub>1</sub> to C<sub>20</sub> aralkyl group.

11. The process of claim 1, wherein R<sup>4</sup> and R<sup>5</sup> are independently a cyclic aralkyl group.

12. The process of claim 1 wherein  $R^4$  and  $R^5$  are independently a group represented by the following formula:



wherein

each  $R^8$  to  $R^{12}$  are independently hydrogen, or a  $C_1$  to  $C_{20}$  alkyl group, a heteroatom, or a heteroatom containing group having up to 40 carbon atoms, and any two R groups can combine to form a cyclic group or a heterocyclic group.

13. The process of claim 12 wherein  
 $R^8$  is methyl, ethyl, propyl or butyl and/or  
 $R^9$  is methyl, ethyl, propyl or butyl, and/or  
 $R^{10}$  is methyl, ethyl, propyl or butyl, and/or  
 $R^{11}$  is methyl, ethyl, propyl or butyl and/or  
 $R^{12}$  is methyl, ethyl, propyl or butyl.

14. The process of claim 13 wherein  
 $R^9$ ,  $R^{10}$  and  $R^{12}$  are methyl and  $R^8$  and  $R^{11}$  are hydrogen.

15. The process of claim 1 wherein the activator comprises alkyl aluminum compounds, alumoxanes, modified alumoxanes, non-coordinating anions, boranes, borates and/or ionizing compounds.

16. The process of claim 1 wherein the olefin comprises ethylene.

17. The process of claim 1 wherein the olefin comprises propylene.

5 18. The process of claim 1 wherein the olefin comprises ethylene and a C<sub>3</sub> to C<sub>20</sub> alpha olefin.

10 19. The process of claim 1, wherein the olefin comprises ethylene and hexene and/or butene.

20. The process of claim 1, wherein the polymer produced has a molecular weight of 200,000 Daltons or more.

21. The process of claim 1 wherein the transition metal compound and/or the activator are placed on a support before being placed in the gas or slurry phase.

22. The process of claim 21 wherein the support is a finely divided polyolefin, talc, or an oxide of silica, magnesia, titania, alumina, or silica-alumina.

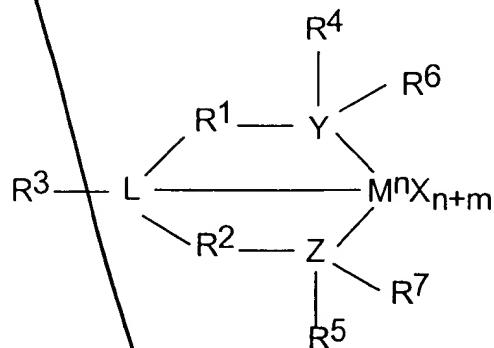
23. The process of claim 1 wherein the transition metal compound and the activator are combined, then placed on a support, then placed in the gas or slurry phase.

24. The process of claim 1 wherein a metal stearate is combined with the transition metal compound and/or the activator and/or a support.

25. The process of claim 24 wherein the metal stearate is an aluminum stearate.

26. The process of claim 25 wherein the aluminum stearate is aluminum distearate.

27. A polymerization process comprising combining in the gas or slurry phase an olefin with an activator, a support and a compound represented by the following formula:



wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

R<sup>1</sup> and R<sup>2</sup> are independently a C<sub>1</sub> to C<sub>20</sub> hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

15 R<sup>1</sup> and R<sup>2</sup> may also be interconnected to each other,

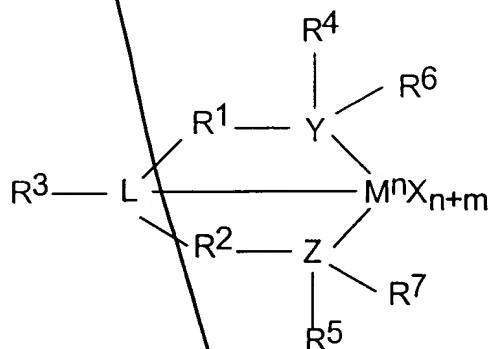
R<sup>3</sup> is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

R<sup>4</sup> and R<sup>5</sup> are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

20 R<sup>6</sup> and R<sup>7</sup> are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group, provided however that L is bound to one of Y or Z and one of R<sup>1</sup> or R<sup>2</sup> is bound to L and not to Y or Z.

28. A process to produce a film comprising extruding, blowing or casting a film from polymer produced by a polymerization process comprising combining an olefin in the gas or slurry phase with an activator, a support and a compound represented by the following formula:

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wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

15 R<sup>1</sup> and R<sup>2</sup> are independently a C<sub>1</sub> to C<sub>20</sub> hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R<sup>1</sup> and R<sup>2</sup> may also be interconnected to each other,

R<sup>3</sup> is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

20 R<sup>4</sup> and R<sup>5</sup> are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

R<sup>6</sup> and R<sup>7</sup> are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.

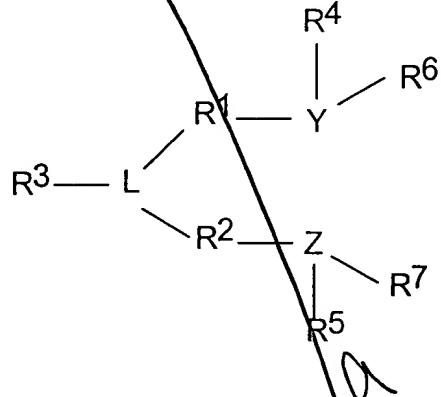
29. The method of claim 28 wherein the film is a blown film.

30. A method to prepare a metal compound comprising reacting a neutral ligand with a compound represented by the formula  $M^nX_n$  (where M is a group 3-14 metal, n is the oxidation state of M, X is an anionic group) in a non-coordinating or weakly coordinating solvent, at about 20 to about 100 °C, then treating the mixture with an excess of an alkylating agent, then recovering the metal complex.

31. The method of claim 30 wherein the solvent has a boiling point above 60 °C.

32. The method of claim 30 wherein the solvent is ether, toluene, xylene, benzene, methylene chloride and/or hexane.

33. The method of claim 30 wherein the neutral ligand is represented by the formula:



Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

R<sup>1</sup> and R<sup>2</sup> are independently a C<sub>1</sub> to C<sub>20</sub> hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

R<sup>1</sup> and R<sup>2</sup> may also be interconnected to each other,

R<sup>3</sup> is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

*Claim 34*  
 $R^4$  and  $R^5$  are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

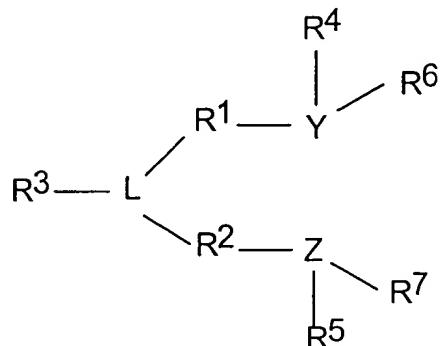
$R^6$  and  $R^7$  are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.

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34. A method to prepare a metal adduct comprising reacting a neutral ligand with a compound represented by the formula  $M^nX_n$  (where  $M$  is Zr or Hf,  $n$  is the oxidation state of  $M$ ,  $X$  is a halogen) in a non-coordinating or weakly coordinating solvent, at 20°C or more, then recovering the metal adduct.

10

35. The method of claim 34, wherein the neutral ligand is represented by the formula:



$Y$  is a group 15 element,

15  $Z$  is a group 15 element,

$L$  is a group 15 or 16 element,

$R^1$  and  $R^2$  are independently a  $C_1$  to  $C_{20}$  hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

$R^1$  and  $R^2$  may also be interconnected to each other,

20  $R^3$  is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

$R^4$  and  $R^5$  are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,

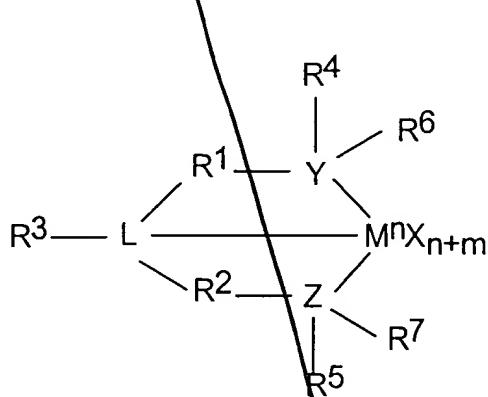
*3 work*

$R^6$  and  $R^7$  are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group

36. The reaction product of a neutral ligand reacted with a compound represented by

5 the formula  $M^nX_n$  (where  $M$  is Zr or Hf,  $n$  is the oxidation state of  $M$ ,  $X$  is an anionic leaving group), in a non-coordinating or weakly coordinating solvent at about 20 to about 100 °C.

37. A composition represented by the formula:



wherein

M is a group 3 to 14 metal,

each X is independently an anionic leaving group,

15 n is the oxidation state of M,

m is the formal charge of the YZL ligand,

Y is a group 15 element,

Z is a group 15 element,

L is a group 15 or 16 element,

20  $R^1$  and  $R^2$  are independently a  $C_1$  to  $C_{20}$  hydrocarbon group, a heteroatom containing group, silicon, germanium, tin, lead, phosphorus, a halogen,

$R^1$  and  $R^2$  may also be interconnected to each other,

$R^3$  is absent, or is hydrogen, a group 14 atom containing group, a halogen, a heteroatom containing group,

*Q3 cont'*  
R<sup>4</sup> and R<sup>5</sup> are independently an aryl group, a substituted aryl group, a cyclic alkyl group, a substituted cyclic alkyl group, or multiple ring system,  
R<sup>6</sup> and R<sup>7</sup> are independently absent or hydrogen, halogen, a heteroatom or a hydrocarbyl group, or a heteroatom containing group.

5  
9 38. The composition of claim 37 wherein M is a group 4, 5 or 6 transition metal.

10 39. The composition of claim 37 wherein M is zirconium or hafnium.

10/11 40. The composition of claim 37 wherein each X is independently hydrogen, halogen or a hydrocarbyl group.

11 41. The composition of claim 37, wherein R<sup>1</sup> and R<sup>2</sup> are independently a C<sub>1</sub> to C<sub>6</sub> hydrocarbon group.

13 42. The composition of claim 37 wherein R<sup>1</sup> and R<sup>2</sup> are a C<sub>1</sub> to C<sub>20</sub> alkyl, aryl or aralkyl group.

14 43. The composition of claim 37 wherein m is 0, -1, -2, or -3 and n is +3, +4 or +5.

14/20 44. The composition of claim 37 wherein R<sup>3</sup> is absent or hydrogen or methyl.

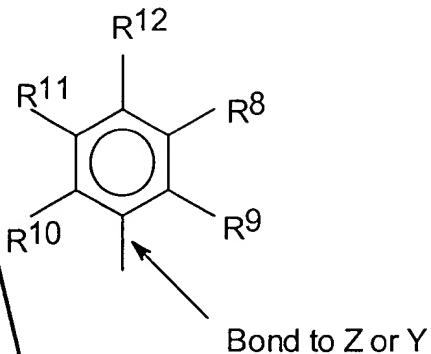
25 45. The composition of claim 37 wherein R<sup>4</sup> and R<sup>5</sup> are independently a C<sub>1</sub> to C<sub>20</sub> hydrocarbon group.

46. The composition of claim 37 wherein R<sup>4</sup> and R<sup>5</sup> are independently a C<sub>1</sub> to C<sub>20</sub> aryl group or a C<sub>1</sub> to C<sub>20</sub> aralkyl group.

30 47. The composition of claim 37 wherein R<sup>4</sup> and R<sup>5</sup> are independently a cyclic aralkyl group.

*Altent*

48. The composition of claim 37 wherein  $R^4$  and  $R^5$  are independently a group represented by the following formula:



wherein

each  $R^8$  to  $R^{12}$  are independently hydrogen, or a  $C_1$  to  $C_{20}$  alkyl group, a heteroatom, or a heteroatom containing group having up to 40 carbon atoms, and any two R groups can combine to form a cyclic group or a heterocyclic group.

49. The composition of claim 48 wherein

$R^8$  is methyl, ethyl, propyl or butyl and/or

$R^9$  is methyl, ethyl, propyl or butyl, and/or

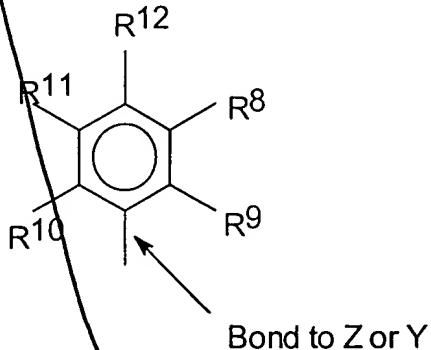
$R^{10}$  is methyl, ethyl, propyl or butyl, and/or

$R^{11}$  is methyl, ethyl, propyl or butyl and/or

$R^{12}$  is methyl, ethyl, propyl or butyl.

21 50. The composition of claim 37 wherein  $R^9$ ,  $R^{10}$  and  $R^{12}$  are methyl and  $R^8$  and  $R^{11}$  20 are hydrogen.

125 51. The composition of claim ~~37~~ wherein M is zirconium, each of Y, A and L is nitrogen, each of R<sup>1</sup> and R<sup>2</sup> is -CH<sub>2</sub>-CH<sub>2</sub>, R<sup>3</sup> is hydrogen, R<sup>6</sup> and R<sup>7</sup> are absent and each of R<sup>4</sup> and R<sup>5</sup> is a group represented by the formula:



5 52. wherein

each R<sup>8</sup> to R<sup>12</sup> are independently hydrogen, or a C<sub>1</sub> to C<sub>20</sub> alkyl group, a heteroatom, or a heteroatom containing group having up to 40 carbon atoms, and any two R groups can combine to form a cyclic group or a heterocyclic group.

10 21 52. The composition of claim ~~51~~ wherein each of R<sup>4</sup> and R<sup>5</sup> is represented by the formula:

